CLAIMS

1. An engine driven by high-pressure gas comprising:

a high-pressure gas tank (7) for storing high-pressure gas;

a movable member (3) displaced when pressure is given from the high-pressure gas tank (7) to the movable member (3), the movable member (3) composing an expansion chamber (4) in which the high-pressure gas is expanded;

a crank means for converting a displacement of the movable member (3) into a rotary motion; and

a heating means for heating the high-pressure gas when a volume of the expansion chamber (4) is expanded by the high-pressure gas supplied into the expansion chamber (4).

2. An engine driven by high-pressure gas according to claim 1, wherein the heating means heats the high-pressure gas when fuel is supplied into the expansion chamber (4) and the thus supplied fuel is burnt in the expansion chamber (4).

3. An engine driven by high-pressure gas according to claim 2, wherein a fuel injection port for supplying liquid fuel into the expansion chamber (4) and a high-pressure gas injection port for supplying the high-pressure gas into the expansion chamber (4) are arranged close to each other.

4. An engine driven by high-pressure gas according to claim 2, wherein the high-pressure gas is a compressed fluid containing at least oxygen.

5. An engine driven by high-pressure gas according to claim 4, further comprising an oxidization facilitating device for facilitating oxidization of oxygen supplied into the expansion chamber (4).

6. An engine driven by high-pressure gas according to claim 2, further comprising: a discharge port (5) for

discharging gas from the expansion chamber (4); and a valve (6) for opening and closing the discharge port (5), wherein fuel is burnt in the expansion chamber (4) under the condition that the gas discharged from the discharge port (5) is sucked and compressed in the expansion chamber (4).

7. An engine driven by high-pressure gas according to claim 6, wherein the gas discharged from the discharge port (5) is sucked and then compressed.

8. An engine driven by high-pressure gas according to claim 6, wherein after suction of the gas discharged from the discharge port (5) is started, fuel is injected into the expansion chamber (4).

9. An engine driven by high-pressure gas according to claim 8, wherein after fuel was injected into the expansion chamber (4), the high-pressure gas is supplied into the expansion chamber (4).

10. An engine driven by high-pressure gas according to claim 2, further comprising a pressure control means for controlling pressure of the high-pressure gas supplied into the expansion chamber (4), wherein the pressure control means controls an output of the engine.

11. An engine driven by high-pressure gas according to claim 10, further comprising a control device for controlling operation of the pressure control means and the heating means, wherein the control device stops the heating means at the time of start the engine and displaces the movable member by the pressure of the high-pressure gas.

12. An engine driven by high-pressure gas according to claim 1, further comprising a high-pressure gas supplying means (10) for supplying high-pressure gas into the high-pressure gas tank (7) by the power of the crank means when the pressure in the high-pressure gas tank (7) is decreased to a value not more than a predetermined value.

13. An air conditioner applied to a movable body

moving by the power of the engine described in claim 12, wherein air blown out into a compartment is heated when high-pressure gas discharged from the high-pressure gas supply means (10) is introduced into the heater (12), and high-pressure gas, from which heat has been emitted, is supplied into the high-pressure gas tank (7) or to the engine.

14. An air conditioner applied to a movable body moving by a power source of the engine described in claim 12, wherein when the engine is operated, the pressure of high-pressure gas discharged from the high-pressure gas supply means (10) is reduced and then introduced into the cooler (13) so as to cool air blown out into a compartment, and when the engine is stopped, the pressure of high-pressure gas supplied from the high-pressure gas tank (7) is reduced and then introduced into the cooler (13) so as to cool air blown out into the compartment, and gas flowed out from the cooler (13) is supplied to the engine.

15. An engine driven by high-pressure gas according to claim 1, wherein the expansion chamber is arranged in an engine body, the expansion chamber includes a piston (3) composing the movable member, a cylinder (2) for accommodating the piston and a gas discharge port connected to an exhaust pipe, the high-pressure gas tank (7) stores gas, the pressure of which is maintained at a value higher than the pressure in the expansion chamber in the case where a volume of the expansion chamber (4) is reduced to the minimum, the high-pressure gas tank (7) is connected to a gas injection device via a pipe,

the engine driven by high-pressure gas further comprising:

a valve (6) for opening and closing the discharge port of the expansion chamber;

a fuel tank (9); and

a fuel injection device for injecting fuel from the fuel tank (9) into the expansion chamber (4),

wherein

the engine body is started by the pressure of high-pressure gas stored in the high-pressure gas tank (7), and the gas remaining in the exhaust pipe is repeatedly sucked into and compressed by the engine body.

16. An engine driven by high-pressure gas according to claim 15, wherein the catalyst (11) is arranged in the exhaust pipe, after the engine body was started in which the temperature of the catalyst (11) reaches an activating temperature of the catalyst, fuel is injected into the expansion chamber, fuel gas in the expansion chamber is compressed, after the gas remaining in the exhaust pipe is sucked, the process is transferred to the compression stroke, when the piston comes to a position close to the upper dead point, high-pressure gas is supplied into the combustion chamber at the pressure of the high-pressure gas tank which is higher than the pressure in the expansion chamber, and fuel in the expansion chamber is ignited and burnt so as to execute the expansion stroke.

17. An engine driven by high-pressure gas according to claim 16, wherein the piston successively repeats at least an expansion stroke in which expansion is conducted, an exhaust stroke, a suction stroke, a compression stroke and the expansion stroke which are conducted in the expansion chamber.

18. An engine driven by high-pressure gas according to claim 17, wherein a volume of the expansion chamber (4) is expanded by the pressure of high-pressure gas injected by the gas injection device in the expansion stroke, a volume of the expansion chamber (4) is shrunk and the remaining gas is discharged from the discharge port (5) into the exhaust pipe in the exhaust stroke, the remaining gas remaining in the exhaust pipe is sucked from the discharge port (5) in the suction stroke, and the volume of the expansion chamber (4) is reduced and gas, which is sucked or injected into the expansion

chamber, is compressed in the compression stroke.

19. An engine driven by high-pressure gas according to claim 17, wherein at the time of operation of the engine conducted after the engine was started, fuel is injected in the middle of the suction stroke or fuel is injected after the process was transferred to the compression stroke, the expansion stroke is composed of an expansion ignition combustion stroke in which high-pressure gas is injected into the expansion chamber by the gas injection device and fuel injected is ignited and burnt,

the exhaust stroke is composed of a stroke in which a volume of the expansion chamber (4) is reduced and the remaining gas is discharged from the discharge port (5) into the exhaust pipe,

the suction stroke is composed of a suction stroke in which the remaining gas remaining in the exhaust pipe is sucked from the discharge port (5), and

the compression stroke is composed of a compression stroke in which gas sucked from or injected into the expansion chamber, the volume of which is reduced, is compressed.

20. An engine driven by high-pressure gas according to claim 19, further comprising a compressor (10) for sucking, compressing and discharging air into a high-pressure gas tank when power is given to the compressor (10) by the engine body, wherein kinetic energy of the vehicle is recovered as pressure energy of high-pressure gas in the case of running on a downward slope or applying the brakes in such a manner that torque of the crank shaft of the engine is transmitted to the compressor (10) under the condition that the discharge port (5) is closed and air pressurized by the compressor (10) is charged into the high-pressure gas tank.

21. An engine driven by high-pressure gas according to claim 19, wherein an output of the engine is adjusted

when the pressure of high-pressure gas supplied into the expansion chamber (4) is adjusted.

22. An engine driven by high-pressure gas according to claim 19, further comprising: a compressor (10) for sucking, compressing and discharging air into a high-pressure gas tank so as to charge air into the high-pressure gas tank when power is given to the compressor 10 by the engine body; and a heat exchanger for exchanging heat between the high-pressure gas discharged from the compressor (10) and the atmospheric air so as to cool the high-pressure gas to a temperature approximate to the outside air temperature, wherein high-pressure gas, the temperature of which has been cooled to a temperature approximate to the outside air temperature by the radiator (11), is supplied into the high-pressure gas tank (7) when the high-pressure gas is charged into the high-pressure gas tank (7).

23. An engine driven by high-pressure gas according to claim 19, further comprising a compressor (10) for sucking, compressing and discharging air into a high-pressure gas tank so as to charge air into the high-pressure gas tank when power is given to the compressor (10) by the engine body, wherein the heater is heated by the heat of high-pressure gas which is heated by the compressor (10), and heat exchange is conducted between the heater and the air blown out into the passenger compartment of the vehicle, on which the engine body is mounted, so as to heat the air blown out into the passenger compartment.